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(54) Connector for airbag system

(57) An electrical connector assembly includes a socket member (20) and a plug member (10) adapted for mating with the socket member (20) along a mating axis (23) of the socket member (20). The socket member (20) has a mating aperture (22) having a side wall portion (24) and a bottom wall portion (25). The side wall portion (24) has a socket slot (26), while the bottom wall portion (25) has at least one pin contact (21) and at least one tab member (27). Each pin contact (21) and each tab member (27) extends from the bottom wall portion (25) substantially parallel to the mating axis (23). The plug member (10) includes a bottom surface (17) and a resilient locking device adapted for engaging in the locking slot (26) of the side wall portion (24) of the socket member (20). The bottom surface (17) has a socket contact aperture (12) corresponding to each pin contact (21) extending from the bottom wall portion (25) of the mating aperture (22) and a tab aperture (16) corresponding to each tab member (27) extending from the bottom wall portion (25) of the mating aperture (22). The resilient locking device includes at least two arms (18) which, upon application of a force to effect separation of the plug member (10) from the socket member (20), spread apart for locking the plug member (10) in the socket member (20) and for preventing separation of the plug member (10) from the socket member (20).

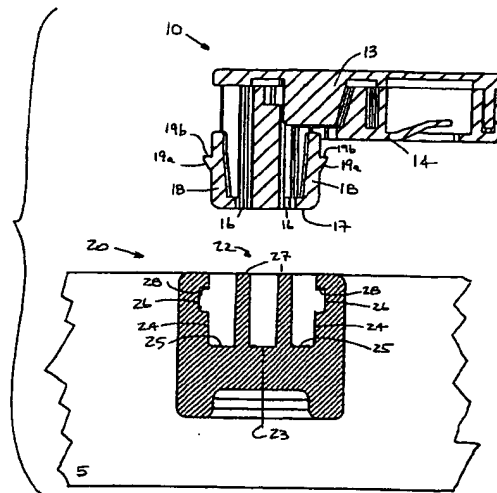


Fig. 1

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Description

BACKGROUND OF THE INVENTION

1. Field of Invention

The present invention relates to electrical connectors for use with vehicle occupant inflatable restraint systems, generally known as airbag systems. More particularly, the present invention relates to a connector plug having an engagement device for engaging with a connector socket of an airbag system.

2. Description of the Related Art

Use of airbag systems in motor vehicles has become virtually universal in recent years and is mandatory in many jurisdictions. Such systems normally include an airbag assembly mounted in a hidden compartment beneath the dashboard and an electrical or electronic control system for activating the assembly upon occurrence of a crash. The airbag assembly is generally connected to the control system by a wiring harness provided with a plug with socket contacts and a socket that receives pin contacts of the initiator.

A connector system of this type is shown, for example, in EP 0 591 947, in which the system is associated with an interlock including a locking element that is inserted into the connection to prevent separation of a pair of male connector elements carried by a first component from a pair of female connector elements carried by a second component and releasably mated therewith. A shorting element is associated with the first component and includes a pair of contact elements each biased into electrical contact with one of the pair of first connector elements for producing a short therebetween. The second component has a body comprising a portion contoured to enter between the pairs of connector elements for disconnecting the short upon mating of the first and second components, which are mechanically latched together. The locking element prevents release of the latch and hence separation of the two components while in the locked position.

In EP 0 537 751, which relates to a switch connector assembly having a structure that prevents admission of water, the female connector has a short-circuiting terminal extending into a connector fitting chamber of the female connector, as well as a temporary arresting projection and a flexible locking arm with a final arresting projection. The male connector has a connecting terminal, a flexible engaging pawl, and an engaging portion. When the temporary arresting projection is fitted with the pawl, the short-circuiting terminal is kept out of contact with the connecting terminal, but the two terminals enter into contact when the final arresting projection is fitted with the engaging portion.

SUMMARY OF THE INVENTION

The present invention provides an electrical connector assembly that includes a socket member and a plug member adapted for mating with the socket member along a mating axis of the socket member. The socket member has a mating aperture that has a side wall portion and a bottom wall portion. The side wall portion has a locking slot, while the bottom wall portion has at least one pin contact and at least one tab member. Each pin contact and each tab member extend from the bottom wall portion substantially parallel to the mating axis. The plug member includes a bottom surface and a resilient locking device adapted for engaging in the locking slot of the side wall portion of the socket member. The bottom surface has a socket contact aperture corresponding to each pin contact extending from the bottom wall portion of the mating aperture and a tab aperture corresponding to each tab member extending from the bottom wall portion of the mating aperture. The resilient locking device includes at least one arm which, upon application of a force to effect separation of the plug member from the socket member, spreads so as to lock the plug member in the socket member and to prevent separation of the plug member from the socket member.

Preferably, each tab member is separated from the side wall portion of the mating aperture, and each arm of the resilient locking device extends from the bottom surface of the plug member and engages the locking slot of the side wall portion of the socket member. The locking slot includes a shoulder portion extending substantially perpendicular to the mating axis. Each arm includes a detent member having a divergent portion and an abutment portion. The abutment portion extends substantially perpendicular to the mating axis and abuts the shoulder portion of the locking slot, preventing separation of the plug member from the socket member upon spreading of the arms when the force is applied.

The plug member includes a socket contact disposed within each socket contact aperture. Each socket contact has a first end for receiving the corresponding pin contact on the airbag initiator side, and a second end for receiving a wire from, for example, the airbag system side. For structural integrity, the plug member includes a cover having laterally located locking lugs, and a socket housing portion having locking lug receiving members engaging the locking lugs of the cover when the cover and socket housing are mated. The cover includes a nipple extending toward the socket housing when the cover and socket housing are mated so that the wire is clasped between the nipple and the socket housing portion. The wire grippers are exchangeable according to the wire diameter.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of exam-

ple and not limitation in the accompanying figures in which like reference numerals indicate similar elements and in which:

Figure 1 is a cross-sectional view of an unmated plug part and an initiator socket part of a connector according to the present invention;

Figure 2 is a top view of a mated plug part and an initiator socket part of a connector according to the present invention;

Figure 3 is a cross-sectional view of a mated plug part and an initiator socket part of a connector according to the present invention, taken along line 3-3 in Figure 2;

Figure 4 is a cross-sectional view of a mated plug part and an initiator socket part of a connector according to the present invention, taken along line 4-4 in Figure 2;

Figure 5 is a cross-sectional view of a mated plug part and an initiator socket part of a connector according to the present invention, taken along line 5-5 in Figure 2;

Figure 6 is a perspective view of a plug part of a connector according to the present invention;

Figure 7 is a bottom view of a plug part of a connector according to the present invention;

Figure 8 is a perspective view of a mated plug part and an initiator socket part of a connector according to the present invention;

Figure 9 is another perspective view of a mated plug part and an initiator socket part of a connector according to the present invention;

Figure 10 is a detail view of the operation of the resilient locking arms on a plug part connector when the plug part is mated with an initiator socket part connector according to the present invention; and

Figure 11 is a detail view of the operation of prior art locking arms.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The electrical connector assembly of the present invention is best illustrated by Figures 1-10. Figure 1 is a cross-sectional view of an unmated plug part 10 and an initiator socket part 20 located on an airbag detonation initiator 5. Plug part 10 is adapted to mate with socket part 20 along mating axis 23 within mating aperture 22 of socket part 20. Figure 2 is a top view of a mated plug part 10 and an initiator socket part 20, while Figure 3 is a cross-sectional view taken along line 3-3 in Figure 2. Figures 8 and 9 are different perspective views of a mated plug part 10 and an initiator socket part 20.

Mating aperture 22 of socket part 20 includes a side wall portion 24 and a bottom wall portion 25. Side wall portion 24 has a locking slot 26. Locking slot 26 includes a shoulder portion 28 that extends substantially perpen-

dicular to mating axis 23. Bottom wall portion 25 has at least one pin 21 contact (Figures 4 and 5) and at least one tab member 27. Each pin contact 21 and each tab member 27 extends from the bottom wall portion 25 substantially parallel to mating axis 23. Each tab member 27 is separated from side wall portion 24 of mating aperture 22.

Plug part 10 includes socket contacts 11 (Figure 5) disposed in socket contact apertures 12. Socket contacts 11 are electrically connected to the conductors of wire 7 (Figure 8). Each socket contact 11 has a first end for receiving a corresponding pin contact 21 and a second end for receiving a conductor of wire 7. Plug part 10 includes a bottom surface 17 having a socket contact aperture 12 (Figure 6) corresponding to each pin contact 21 extending from bottom wall portion 25 of mating aperture 22, and a tab aperture 16 corresponding to each tab member 27 extending from bottom wall member 25 of mating aperture 22. Apertures 16 and tabs 27 mate together, providing both correct orientation of plug part 10 and socket part 20 when mated and structural integrity against a torsional force applied to plug part 10. Figure 6 is a perspective view and Figure 7 is a bottom view of a plug part 10 showing that apertures 16 can each have different cross-sectional shapes to provide connector keying.

Plug part 10 also includes a resilient locking device having at least one arm 18. Each arm 18 extends from bottom surface 17 of plug member 10 and is adapted for engaging locking slot 26 of side wall portion 24 of mating aperture 22. Each arm 18 includes a detent member 19 that has a divergent portion 19a and an abutment portion 19b. Abutment portion 19b extends substantially perpendicular to mating axis 23 and abuts shoulder portion 28 of locking slot 26, preventing separation of plug part 10 from socket part 20 by spreading arms 18 when a force 30 is applied.

Figure 10 shows that, upon application of a force 30 to effect separation of the plug member from the socket member, arms 18 operate to spread apart in the direction of arrows 32 from locking plug part 10 when plug part 10 is in socket part 20, and to prevent separation of plug part 10 from socket part 20. Figure 11 shows that, in the prior art, arms 38 respond to an application of a force 30 by moving radially together in the direction of arrows 33, allowing the plug part to be separated from the socket part.

Plug part 10 includes a cover 13 and a socket housing 14. Laterally located locking lugs 8 on cover 13 engage locking lug receiving members 9 on socket housing 14 (Figures 8 and 9) when cover 13 and socket housing 14 are mated. Socket housing 14 and cover 13 include nipples 15 (Figure 4) that firmly hold wire 7 when cover 13 and socket housing 14 mate together and operates as a stress relief device for wire 7.

Claims

1. All electrical assembly comprising:

(a) a socket member (20) having a mating aperture (22), the mating aperture (22) having a mating axis (23), a side wall portion (24) and a bottom wall portion (25), the side wall portion (24) having a locking slot (26), the bottom wall portion (25) having at least one pin contact (21) and at least one tab member (27), each pin contact (21) and each tab member (27) extending from the bottom wall portion (25) substantially parallel to the mating axis (23); and

(b) a plug member (10) adapted for mating with the socket member (20) by insertion in the mating aperture (22) along the mating axis (23), the plug member (10) including

(i) a bottom surface (17) having a socket contact aperture (12) corresponding to each pin contact (21) extending from the bottom wall portion (25) of the mating aperture (22) and a tab aperture (16) corresponding to each tab member (27) extending from the bottom wall portion (25) of the mating aperture (22), and

(ii) a resilient locking device adapted for engaging in the locking slot (26) of the side wall portion (24) of the socket member (20), the resilient locking device including at least two arms (18) which, upon application of a force to effect separation of the plug member (10) from the socket member (20), spread apart for locking the plug member (10) in the socket member (20) and for preventing separation of the plug member (10) from the socket member (20).

2. All electrical connector assembly according to claim 1, wherein each tab member (27) is separated from the side wall portion (24) of the mating aperture (22), and each arm (18) of the resilient locking device extends from the bottom surface (17) of the plug member (10) and engages the locking slot (26) of the side wall portion (24) of the socket member (20).

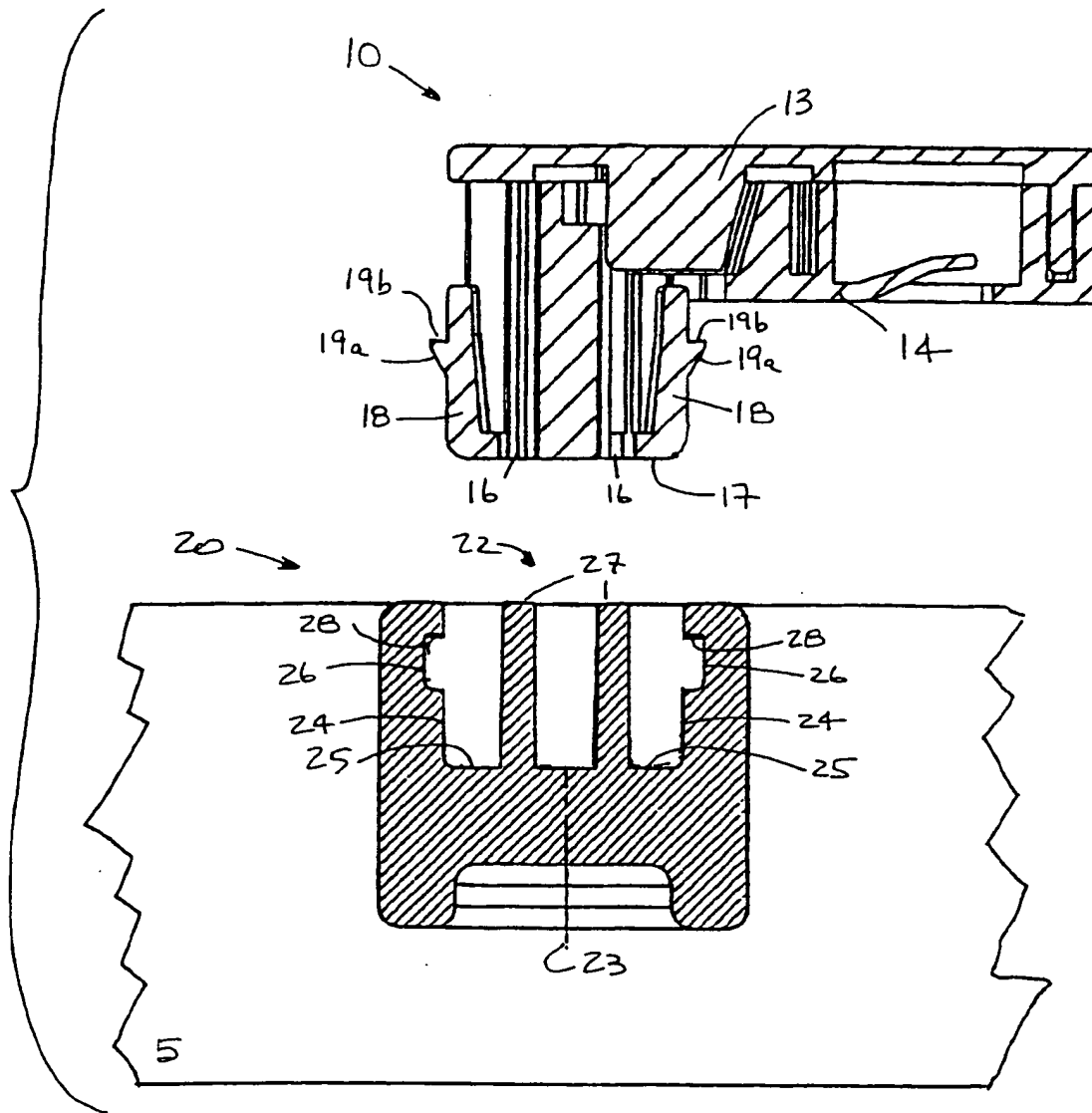
3. All electrical connector assembly according to claim 2, wherein the locking slot (26) includes a shoulder portion (28) extending substantially perpendicular to the mating axis (23), and each arm (18) includes a detent member (19), the detent member (19) having a divergent portion

(19a) and an abutment portion (19b), the abutment portion (19a) extending substantially perpendicular to the mating axis (23) and abutting the shoulder portion (28) of the locking slot (26) preventing separation of the plug member (10) from the socket member (20) upon spreading of the arms (18) when the force is applied.

4. All electrical connector assembly according to claim 1, wherein the plug member includes a socket contact (11) disposed within each socket contact aperture (12), each socket contact (11) having a first end and a second end, the first end of each socket contact (11) receiving the corresponding pin contact (21) and second end of each socket contact (11) receiving a wire (7).

5. All electrical connector assembly according to claim 4, wherein the plug member (10) comprises a cover (13) having laterally located locking lugs (8), and a socket housing portion having locking lug receiving members (9) engaging the locking lugs (8) of the cover (13) when the cover (13) and socket housing (14) are mated.

6. All electrical connector assembly according to claim 5, wherein the socket housing (14) and cover (13) includes a nipple (15) extending toward the cover (13) and the housing (14) when the socket housing (14) and the cover (13) are mated, the wire (7) being clamped between the nipple (15) and the cover (13).



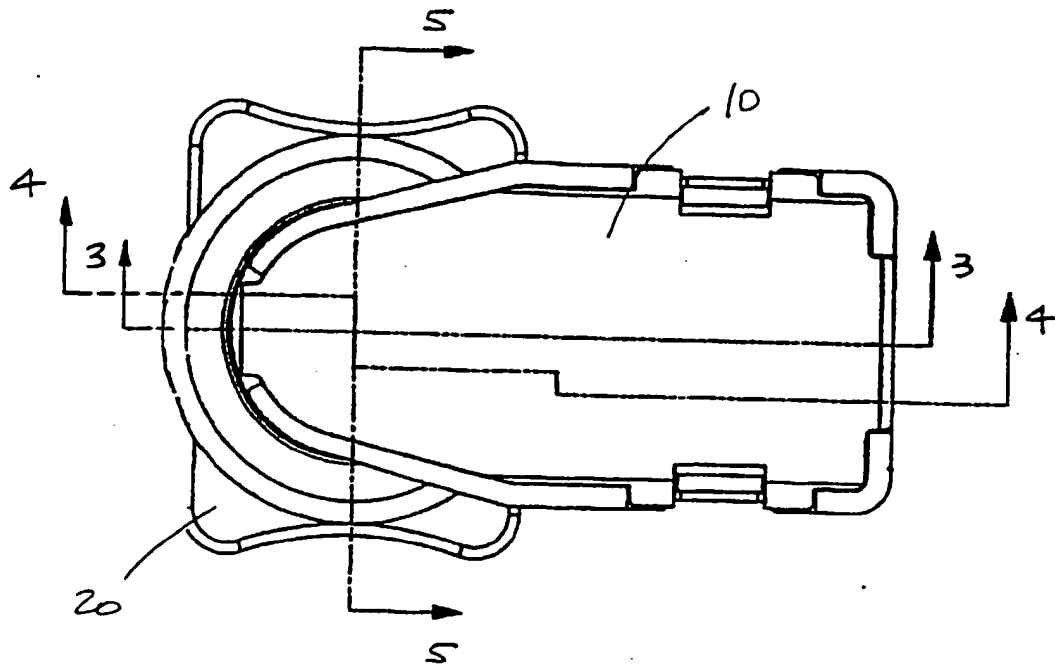
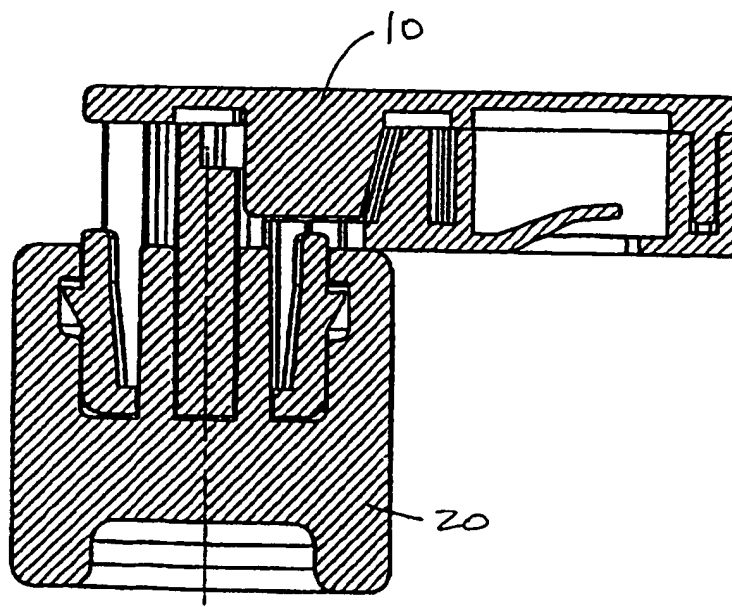
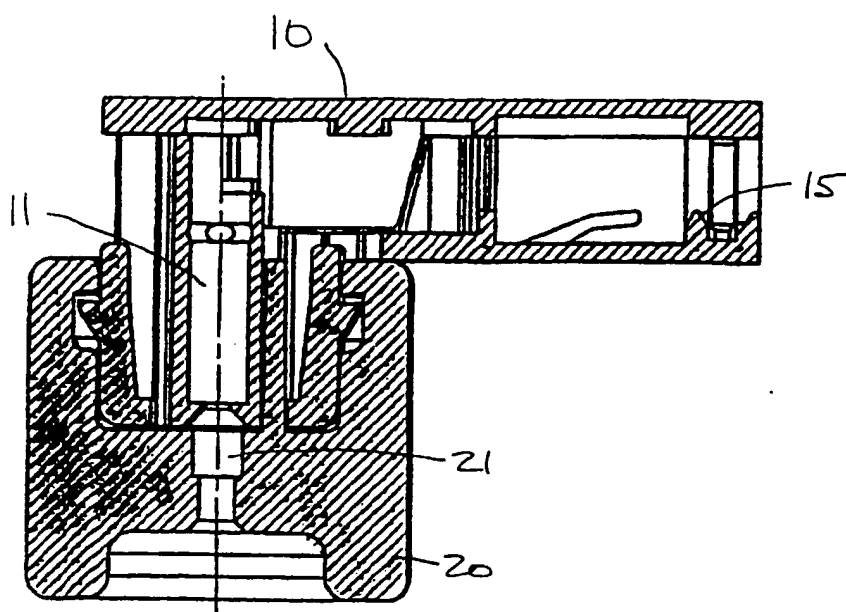


Fig. 2

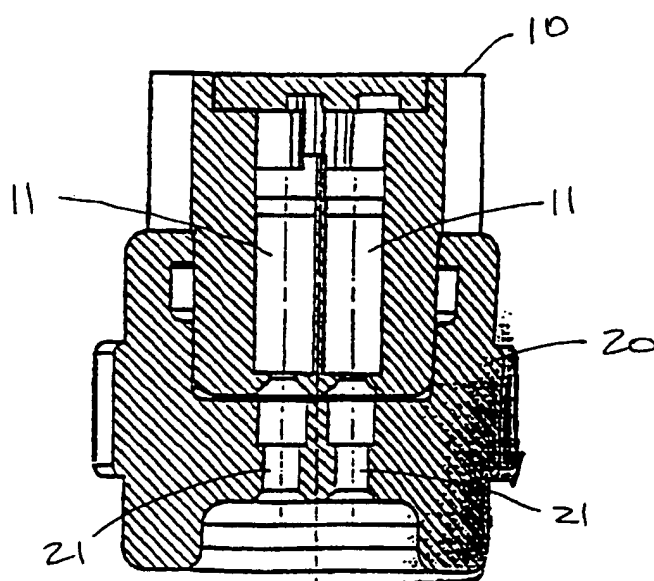


VIEW 3-3
Fig. 3



VIEW 4-4

FIG. 4



VIEW 5-5

FIG. 5

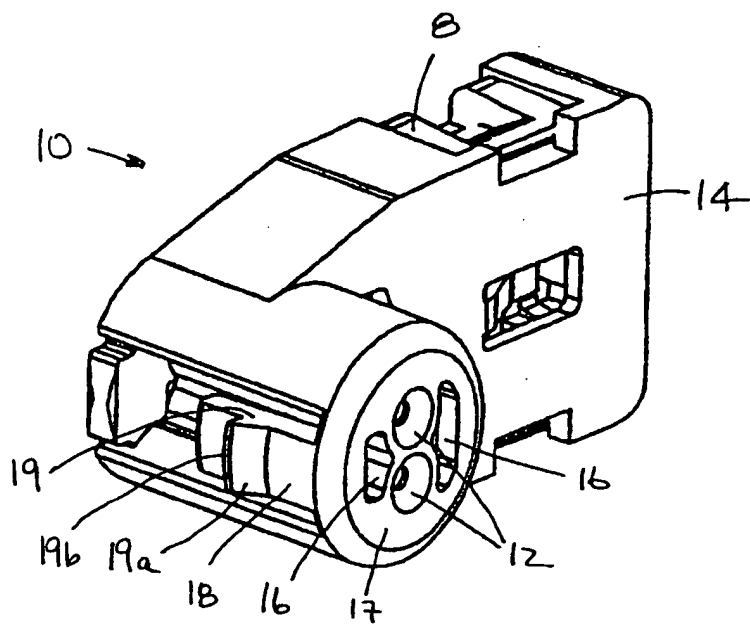


Fig. 6

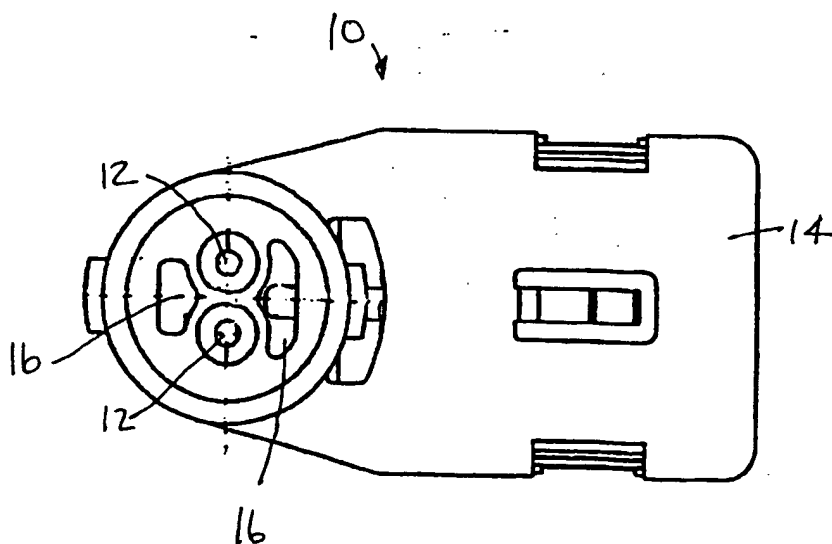


Fig. 7

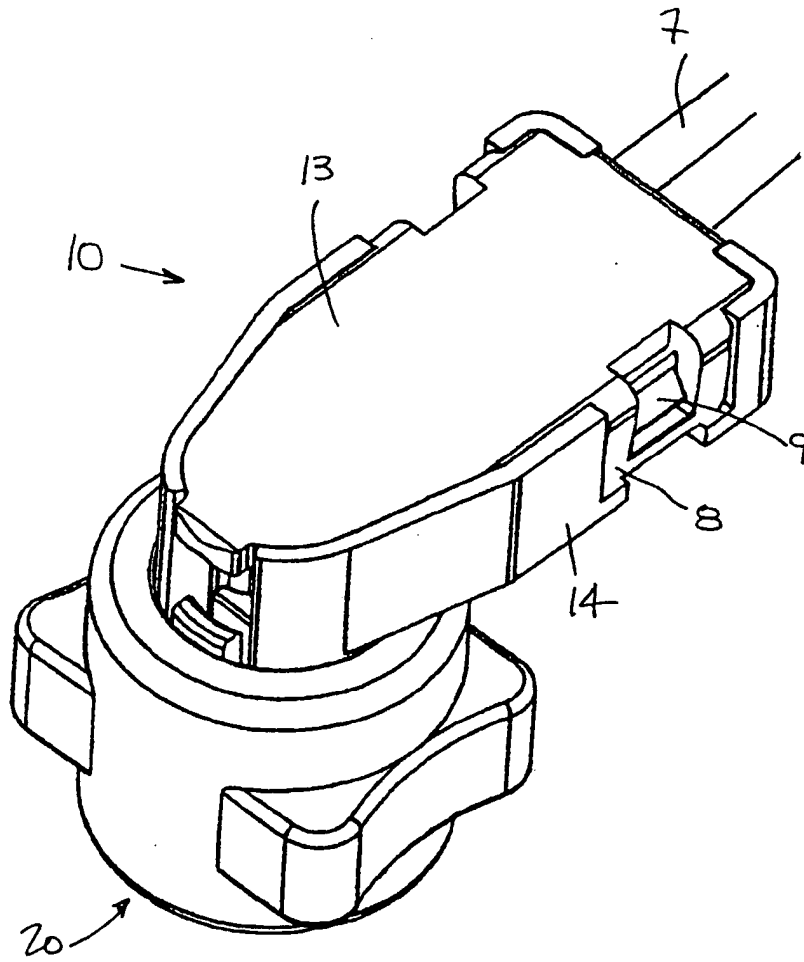


Fig. 8

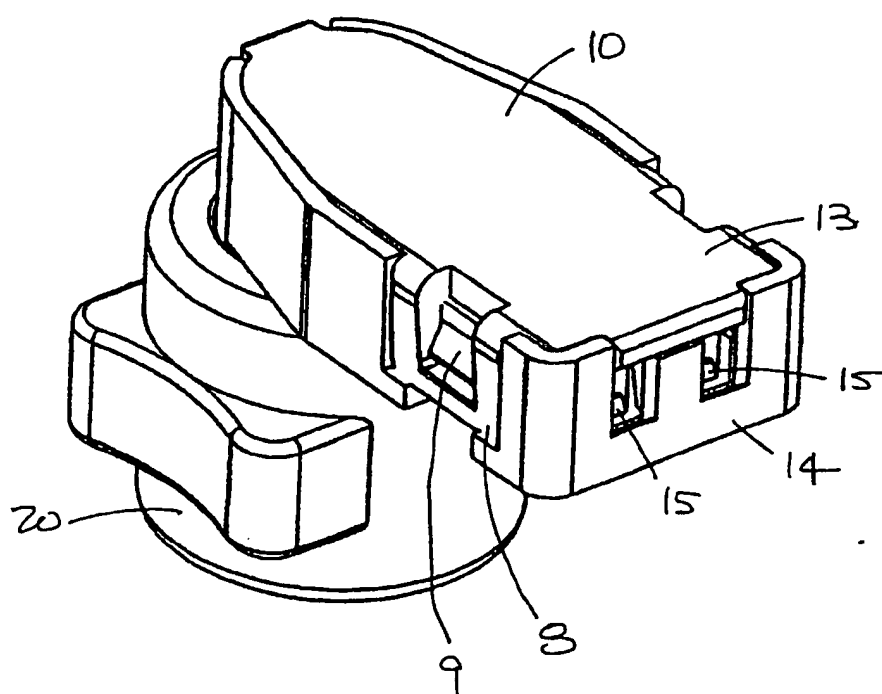


Fig. 9

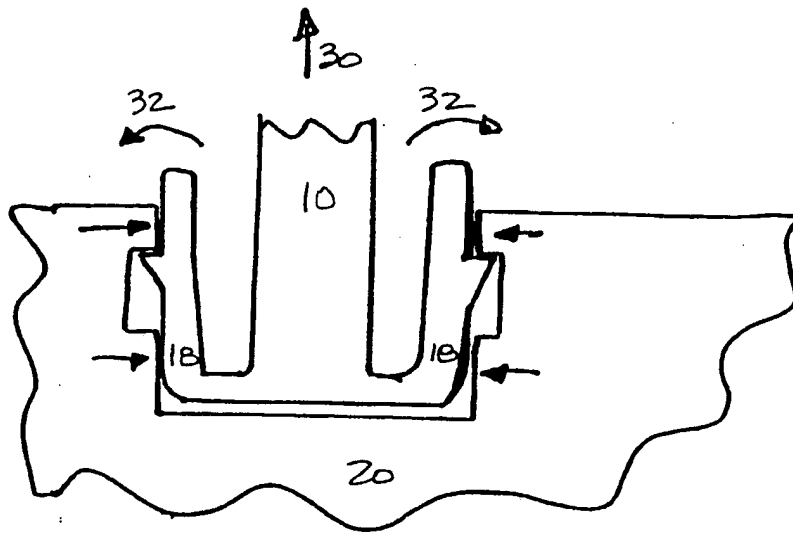
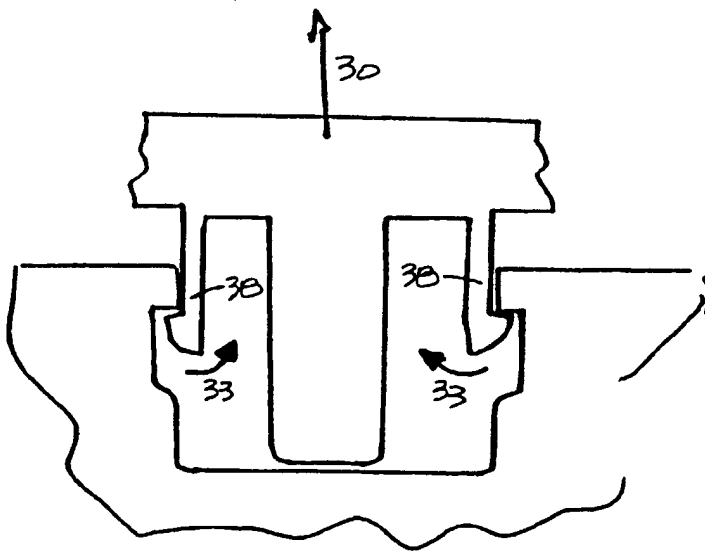
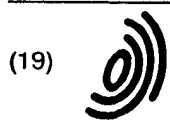


FIG. 10



PRIOR ART

FIG. 11



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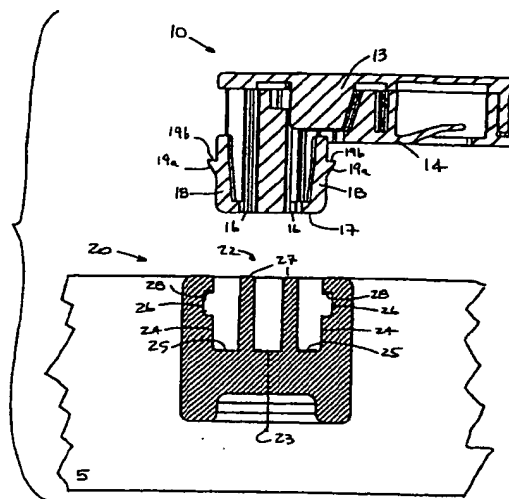


Fig. 1

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European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 97 11 5422

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A,D	EP 0 537 751 A (YAZAKI) 21 April 1993 (1993-04-21) * claim 1; figures 3-5,7-9,11,12,14,15 *	1	H01R13/627
P,A	US 5 609 498 A (MUZSLAY STEVEN Z) 11 March 1997 (1997-03-11) * claim 1; figures 1-5 *	1	
P,A	EP 0 731 532 A (FRAMATOME CONNECTORS INT) 11 September 1996 (1996-09-11) * claim 1; figures 1,2 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H01R
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 October 1999	Examiner Demolder, J
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 97 11 5422

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US 5609498 A	11-03-1997	NONE	
EP 0731532 A	11-09-1996	NONE	

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